Bulletin of the Yorkshire Naturalists' Union 47 Supplement: 46-49

A PROBLEM ARISING FROM THE STUDY OF THE WASPS AND BEES (HYMENOPTERA: ACULEATA) OF YORK'S VICTORIAN CEMETERY

MICHAEL ARCHER (2007)

Information about the aculeate wasps and bees of York's Victorian cemetery is given by Archer (2004), to which reference should be made for further information. The aim of this paper is to consider a problem not dealt with in Archer (2004). The problem is why so many visits were necessary before a 'reliable' estimate of the number of wasp and bee species present in the cemetery was obtained.

The cemetery is like a large urban garden. Davis (1978) found that urbanisation leads to the reduction in size and number of semi-natural habitats, although some new habitats, particularly disturbed habitats, may be created. Generally on such habitats there is a decline and loss of species, especially those with specialised micro-habitat requirements, compared with the original semi-natural habitats.

Seventy-one species of aculeate wasps and bees have been recorded in the cemetery although only two of these species, *Crossocerus distinguendus* (Morawitz) and *Hylaeus signatus* (Panzer) may be considered as nationally scarce species. As a rough guide, any Watsonian Yorkshire site with 60 or more species may be considered a good site. An excellent Yorkshire site would have over 100 species.

A basic question in the study of any site is of not knowing how many species remain to be recorded. Recent advances in non-parametric statistical procedures offer a way of answering this question. Based on the 55 solitary species recorded from the cemetery the Chao presence/absence procedure gave a stable estimate that about 64 solitary species could be potentially present in the cemetery. Thus, about 86% of this potential number of solitary species had been recorded. A second procedure, the first order Jackknife, indicated a stable estimate of about 68 solitary species could potentially be present, about 81% of those recorded. Since these two stable estimates closely agree with each other and indicate that few species remain to be found it can be assumed that the community characteristics of the solitary wasps and bees can now be considered. The community

characteristics of 'cleptoparasitic load' and 'aerial nester frequency' will be considered later.

Thirty-four visits to the cemetery were necessary before the above stable estimates were obtained. Usually far fewer visits to a site are necessary. Nine to twelve visits were needed at the following sand dune sites: North Walney Island and Sandscale Haws in Cumbria, Lindisfarne in Northumbria and Gibraltar Point and Saltfleetby-Theddlethorpe in Lincolnshire. Thirteen to 17 visits were needed at the following sandy sites situated in relatively undeveloped sandy countryside: Highgate Common in Staffordshire, Devils Spittleful in Worcestershire, Rampart Fields in Norfolk, Thetford Warren Lodge in Suffolk and Kirby Moor in Lincolnshire. The problem then is why so many visits to the cemetery were needed?

An isolated site, Messingham Sand Quarry in Lincolnshire which is surrounded by intensive agriculture required a large number of 28 visits (Archer, 2003). The problem for this site was answered as follows. The recorded species at any site could be resident, tourist or vagrant species. Resident species obtain all their resources, mainly nesting sites and food, from the site under study while tourist species, although living in the geographical area of the site under study, do not normally obtain their resources from the site. Vagrant species normally occur away from the geographical area of the site. It is often difficult to separate resident from tourist species. Probably tourist species will tend to be found on one or a few visits, as only small numbers would be expected to be present on the site and hence less likely to be found. Unfortunately, species found on one or a few visits could also be rare resident species which again have small numbers on site and are less likely to be found. For Messingham Sand Quarry it was possible to propose three arguments to separate tourist and resident species (Archer, 2003). When the tourist species were removed a stable estimate of the potential was possible after only 19 visits.

The cemetery could be considered an isolated site since it is surrounded by urban development. However, since much of this urban development consists of houses with gardens, the cemetery may not be so isolated if the wasp or bee species are able to fly between the gardens and the cemetery. At the cemetery one vagrant species, *Eumenes papillarius* (Christ) was found. *E. papillarius* is not a British species but is found on mainland

Europe just across the English Channel. It proved impossible to develop arguments to separate the remaining 55 solitary wasp and bee species into tourist and resident species. Another solution to the problem was needed.

The cleptoparasitic load (CL) is the percentage of aculeate species that are cleptoparasites (or parasitoids) on other host aculeates. The CL for solitary wasps at the cemetery is 14.1% which is included within the narrow range 10.3%-24.4% found at 28 other sites. The CL for the solitary bees from the cemetery is 16.7% which is smaller than the narrow range 22.5%-40.0% found at other sites. Why should this be so? The low CL value for the solitary bees was due to the lack of cleptoparasitic species. Cleptoparasites are often found around the nest sites of their hosts. Perhaps some of the host solitary bee species were using the cemetery as a food resource but nesting outside the cemetery. As such, all of the cleptoparasites would not be recorded. This speculation also implies that for some solitary bees the cemetery is only part of a larger site of unknown area in which they are resident species.

The above speculation would indicate that for the solitary wasps the area of the cemetery was large enough for them to be resident species within the cemetery. Why should solitary wasp species be different from solitary bee species? On average, the solitary wasps are smaller than the solitary bees so perhaps are unable regularly to fly between the cemetery and surrounding gardens.

The aerial-nester frequency (AF) is the percentage of host aculeate species that have aerial nest sites. Aerial nesters use old beetle burrows in dead wood, central stem cavities (e.g., bramble), old snail shells, or crevices in old walls, or exposed on the surface of rock or other hard material. Subterranean nesters nest in the soil, usually in burrows dug by themselves, but sometimes holes and crevices are used after being altered. The AF for the solitary wasp species at 81.0% is very high compared with the British solitary wasp AF of 46.2%. Only four species of subterranean nesting solitary wasp species were recorded and the nest site of only one of these species was found. This nest site area only lasted one year because of human disturbance. The majority of the solitary wasp species were aerial nesters mainly in crevices in an old wall, in dead wood which had been brought to the site and dead bramble stems which were abundant. The

cemetery is not a favourable habitat for subterranean nesting solitary wasps.

The AF for the solitary bee species of 40.0% is also very high compared with the British solitary bee AF of 17.9%. Again, the cemetery is an unfavourable nesting habitat for subterranean nesting solitary bees. No subterranean nesting sites of solitary bee species were found in the cemetery.

In conclusion, the solitary wasp species recorded from the cemetery are mainly resident species using aerial nesting sites. The solitary bee species are mainly resident species of a larger area than the cemetery, using the cemetery as a food source but with subterranean nesters tending to nest outside the cemetery. From the list of recorded host solitary bee species (Archer, 2004), a further seven additional cleptoparasitic species, not yet recorded, could easily be present, at least, outside the cemetery in the larger area. With these extra cleptoparasitic species the solitary bee CL becomes 34.4% which is within the narrow range of CLs.

REFERENCES

Archer, M.E. 2003. The wasps and bees (Hymenoptera: Aculeata) of Messingham Sand Quarry in Watsonian Lincolnshire with special reference to resident and tourist species. *Naturalist* **128**: 93-102.

Archer, M.E. 2004. The wasps and bees (Hymenoptera: Aculeata) of York's Victorian cemetery in Watsonian Yorkshire. *Naturalist* **129**: 145-153.

Davis, B.N.K. 1978. Urbanisation and the diversity of insects. In *Symposia of the Royal Entomological Society of London* **9**. *Diversity of Insect Fauna.* L.A. Mound N. and Waloff eds: 126-138.